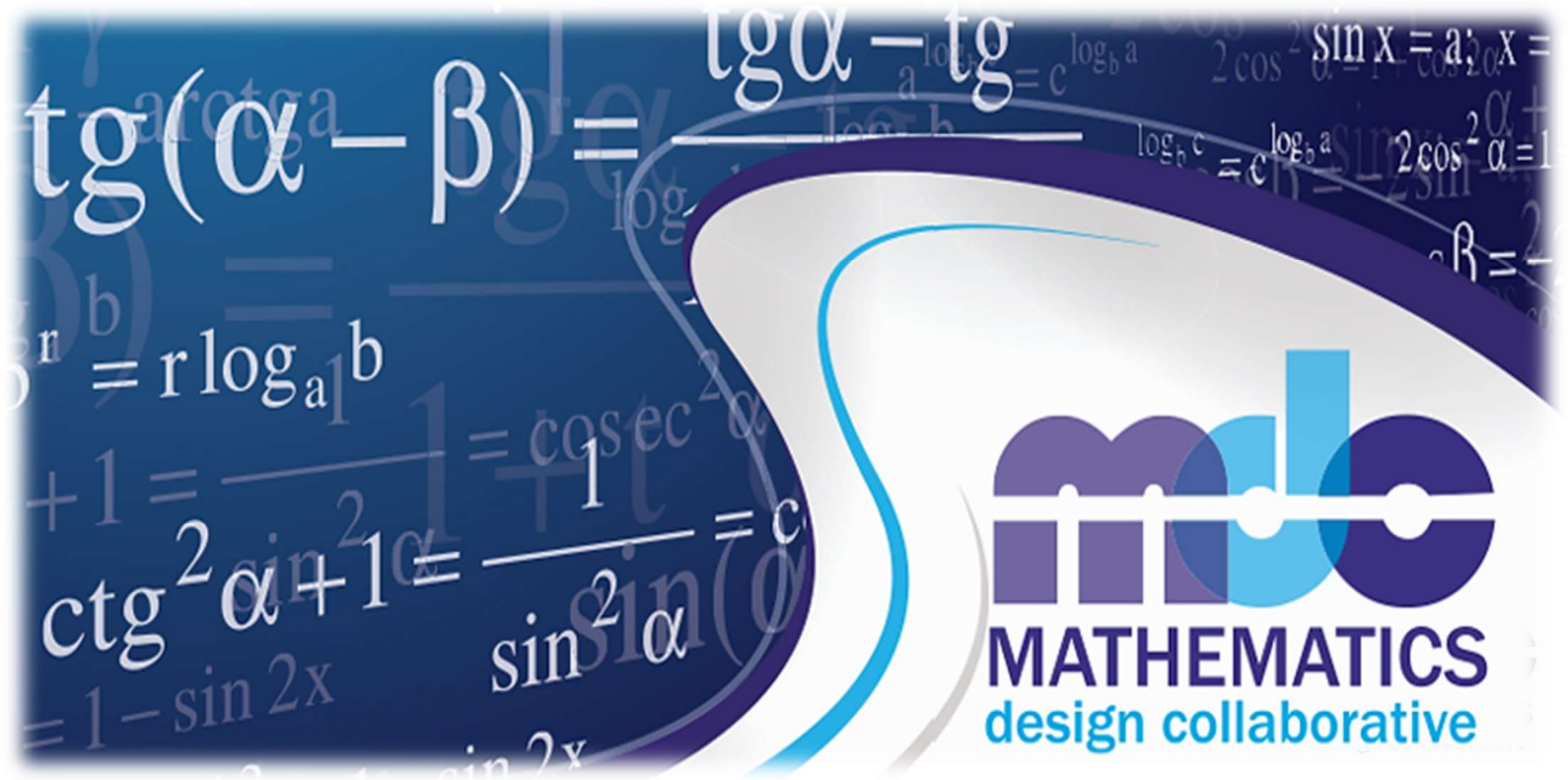


Welcome to...

Using Math Design Collaborative Resources to
Enhance Conceptual Understanding and
Promote Problem Solving



Goals For Today

- What do students need to be able to do in math?
- Refresher: What is Formative Assessment?
- Math Design Collaborative- What is it?
- Connecting Formative Assessment and MDC Resources
- Formative Assessment Lessons
- MDC Resources

MDC is a national initiative that is working to provide teachers with a framework for designing and implementing **formative assessment lessons (FALs)** that provide teachers with formative assessment data and opportunities for feedback...

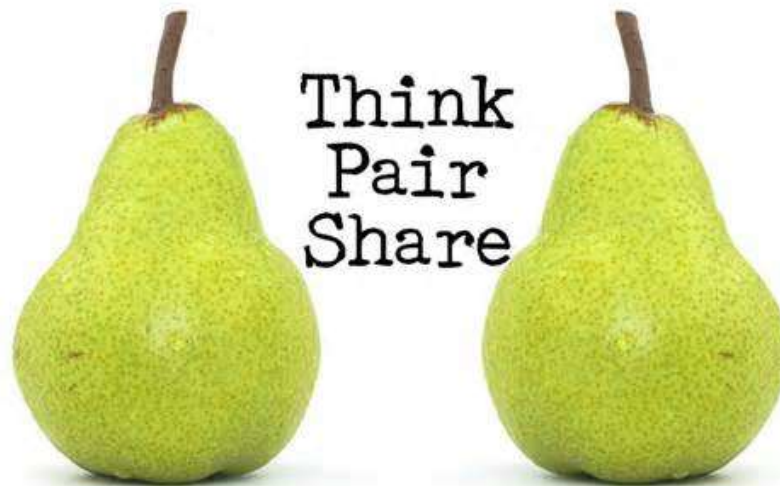
As well as, providing scripted, well-engineered, exemplary FALS to support US schools in implementing the Common Core State Standards for Mathematics (CCSS).

MDC- Benefits for Students

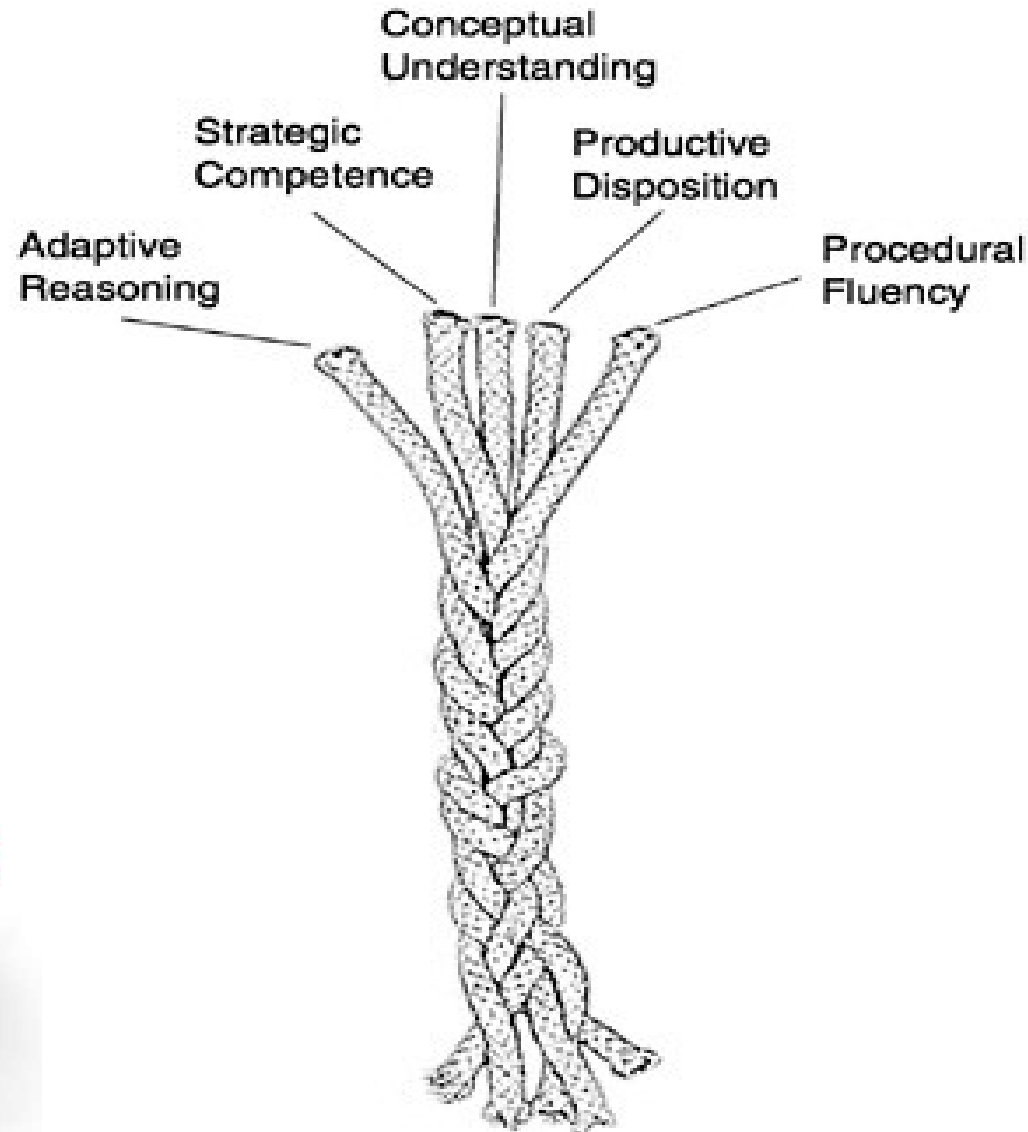
- Allows students to see and talk about multiple representations of answers to the same problems.
- Encourages students to work in teams to come up with a shared, workable solution(s).
- Students become risk takers persevering in problem solving to increase conceptual understanding mathematical concepts.
- Strengthens 8 Mathematical Practices.
- Proven academic gains by students who have been exposed to the MDC framework.

PART 1:

To be proficient in math,
what do students need
to be able to do?



5 Essential Strands



- ***conceptual understanding***— comprehension of mathematical concepts, operations, and relations
- ***procedural fluency***— skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- ***strategic competence***— ability to formulate, represent, and solve mathematical problems
- ***adaptive reasoning***— capacity for logical thought, reflection, explanation, and justification
- ***productive disposition***— habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy

As a teacher I can ...

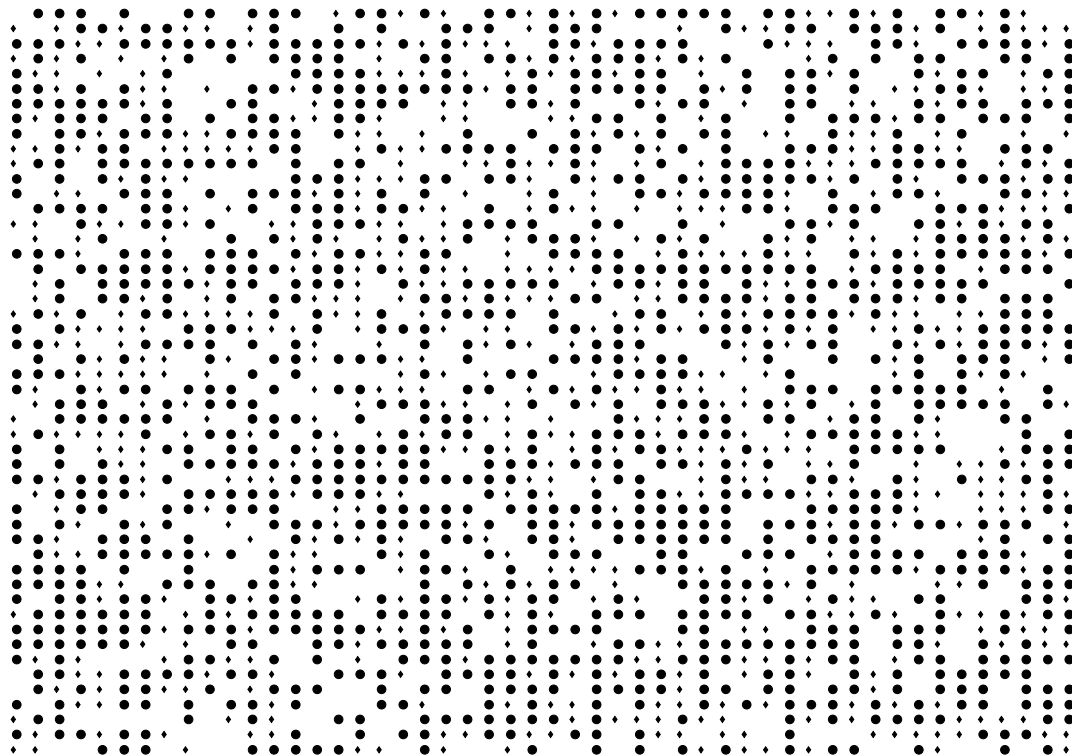
- conceptual understanding
- procedural fluency
- strategic competence
- adaptive reasoning
- productive disposition
- modeling, mapping, building vocabulary
- detect errors, peer-coaching, mental math, Math 24
- teaching strategies, talking about math / restating ideas
- organized -logic, presenting, convince me that you're right
- CAN DO MATH ! "I can..."statements

Just for Fun...



Counting Trees

The diagram shows some trees in a tree farm.



The circles show old trees and the triangles show young trees.

Tom wants to know how many trees there are of each type, but says it would take too long counting them all, one by one.

Analyzing Sample Responses to Discuss

1. Does the approach make mathematical sense?
2. What assumptions has the student made?
3. How could the solution be improved?
4. What questions could you ask the student, to help you understand their work?

Sample Responses to Discuss:

Laura

① You could multiply the number of trees in the length by the number of trees in the width and then of half your answer.

② a. Old trees - 644
Young trees - 644

width - 33
length - 39.

$$33 \times 39 = 1287$$

$$1287 \div 2 = 643.5 = 644$$

Sample Responses to Discuss: Wayne

2 columns has 21 young trees
55 old trees

50 columns is approx

$$50 \div 2 = 25$$

$$25 \times 21 = \text{amount of young trees} = 525$$

$$25 \times 55 = \text{amount of old trees} = 1,375$$

rounded up

young 530
old 1,380

Sample Responses to Discuss:

Counting trees

1. If Tom draws a 10X10 square round some trees and counts how many old and new there are. There are 50 rows and 50 columns altogether so he must multiply by 25. He could do this a few times to check and then take the average.

2.

$$\begin{array}{rcl}
 53 \text{ old} & \times 25 & = 1325 \text{ old} \\
 28 \text{ new} & \times 25 & = 700 \text{ new} \\
 19 \text{ spaces} & \times 25 & = 475 \text{ spaces} \\
 \hline
 100 & & 2500
 \end{array}$$

$$1325 + 1200 \div 2 = 1262.5$$

$$700 + 875 \div 2 = 787.5$$

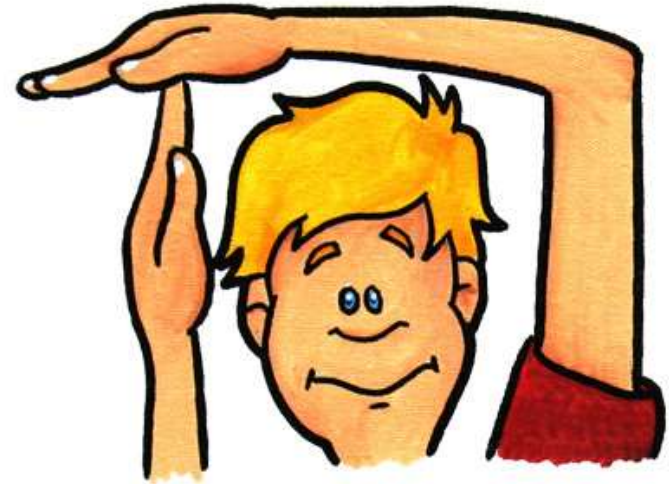
check

$$\begin{array}{rcl}
 48 \text{ old} & \times 25 & = 1200 \text{ old} \\
 35 \text{ new} & \times 25 & = 875 \text{ new} \\
 17 \text{ spaces} & \times 25 & = 425 \text{ spaces} \\
 \hline
 100 & & 2500
 \end{array}$$

So about 1263 old trees
and 788 new trees

PART 2

How do I know if my students are proficient in their understanding of the material that I am teaching?



TIME OUT!!!

In your own words:

What is formative assessment?

—With your elbow buddy, write a definition on the marker board.



Defining Formative Assessment

- Formative assessment is defined as a **process** used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes.

CCSSO, Definition of formative assessment, 2008

What are FALs?

Formative Assessment Lessons (FALs) are intended to engage students in a productive struggle that builds fluency with their procedural skills, and deepens mathematical reasoning and understanding.

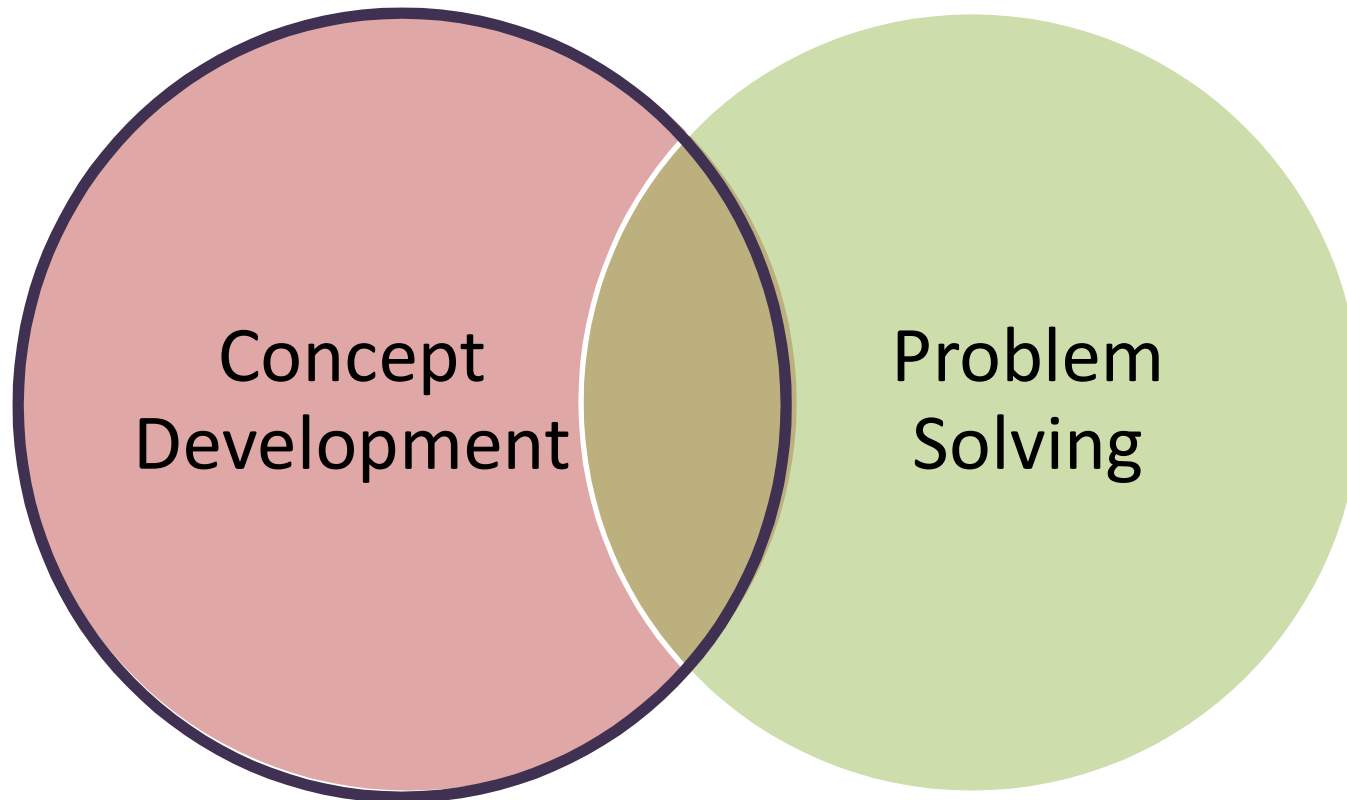
FALs are meant to assist teachers in ASSESSMENT FOR LEARNING.



MDC resources are FREE.

Two Types of FALs

Classroom Challenges



Concept Development FALs



Concept Development Lessons

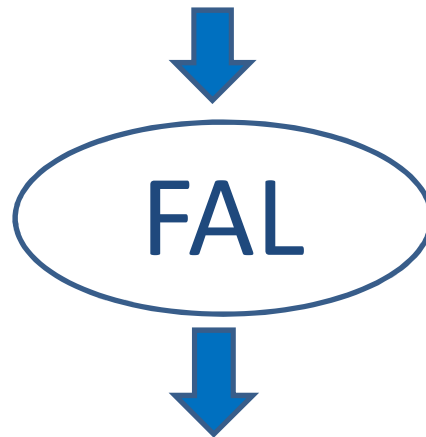
In a nutshell



Concept Development FALs are designed to reveal students' prior knowledge and misconceptions so that instruction can be designed to develop students' understanding of important mathematical concepts and connect concepts to other mathematical knowledge.

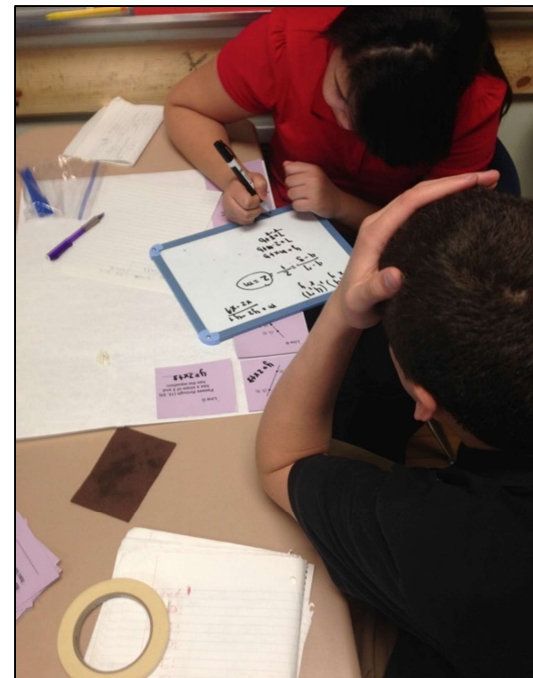
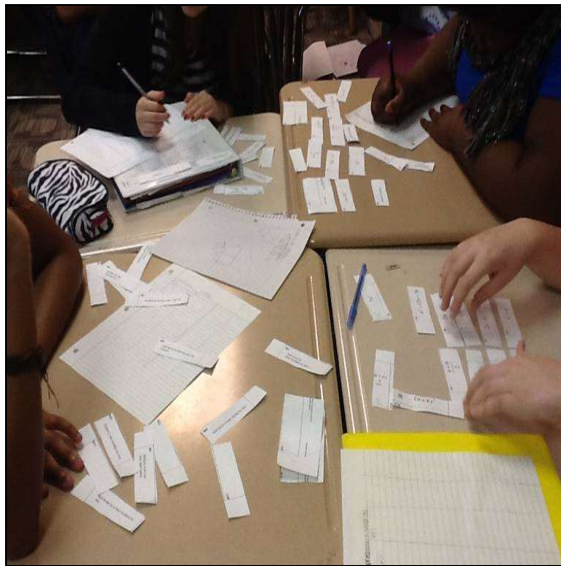
How do I use a Concept Development FAL?

Teach ----- approximately 2/3 of unit



Teach ----- remaining 1/3 with modifications of instruction to clear up identified misconceptions

- For **concept development** lessons
 - Homogeneous grouping
 - Partners for maximum interaction



Lets Take A LOOK

**PA- MDC GRADE 3
REPRESENTATIONS OF
MULTIPLICATION**

This lesson is intended to evaluate the understanding of your students in multiplication and how well students are able to interpret various representations of multiplication facts.

This lesson was adapted from Kentucky Department of Education and MakingMathMagic.com

Concept Development Formative Assessment Lesson

mdc
MATHEMATICS
design collaborative

been drawn from commonly identified student misconceptions. These can be written on the board at the end of the lesson before students revisit initial task.

We suggest that you write a list of your own questions, based on your students' work, using the ideas that follow. You may choose to write questions on each student's work. If you do not have time to do this, select a few questions that will be of help to the majority of students.

Below is a list of common issues and questions/prompts that may be written on individual initial tasks or during the collaborative activity to help students clarify and extend their thinking.

Common Issues	Suggested Questions and Prompts
A group has trouble getting started.	<ul style="list-style-type: none"> What information do you already know? What do you need to find out?
Students have trouble drawing correct representation.	<ul style="list-style-type: none"> Use an example of cards that have already been matched and discuss. For example, the 3 groups of 4 card. Talk about how the picture and context of the problem would change if the card was 4 groups of 3.
Students may draw 3 groups of 6 instead of drawing 6 groups of 3.	<ul style="list-style-type: none"> How is this model different if we turn it on its side? Is the orientation of the model important?
Students are not attentive to the orientation of the array models.	<ul style="list-style-type: none"> How does the order of the factors affect the model? Can you think of a situation that changing the order of the problem would not work? For example, if I have a party and I prepare 3 bags with 9 cookies in each bag. I will have 9 people at the party and each should get 3 cookies. Did the order matter?
Students misinterpret correct representation of each multiple in the problem. Although arranging the problem either way gives you the same answer, mathematically, it does not represent the same image.	<ul style="list-style-type: none"> Provide manipulatives for students. Can you draw a model? Can you act out what the problem is telling you?
Students are not attentive to details and structure of the word problems.	

Please use the blanks to add your class misconceptions and directed questions.

5

Pre/Post Assessment

Name: _____

Multiplication

Using the multiplication problem at the top of each chart, create a representation of the problem that matches the labels in each of the four boxes.

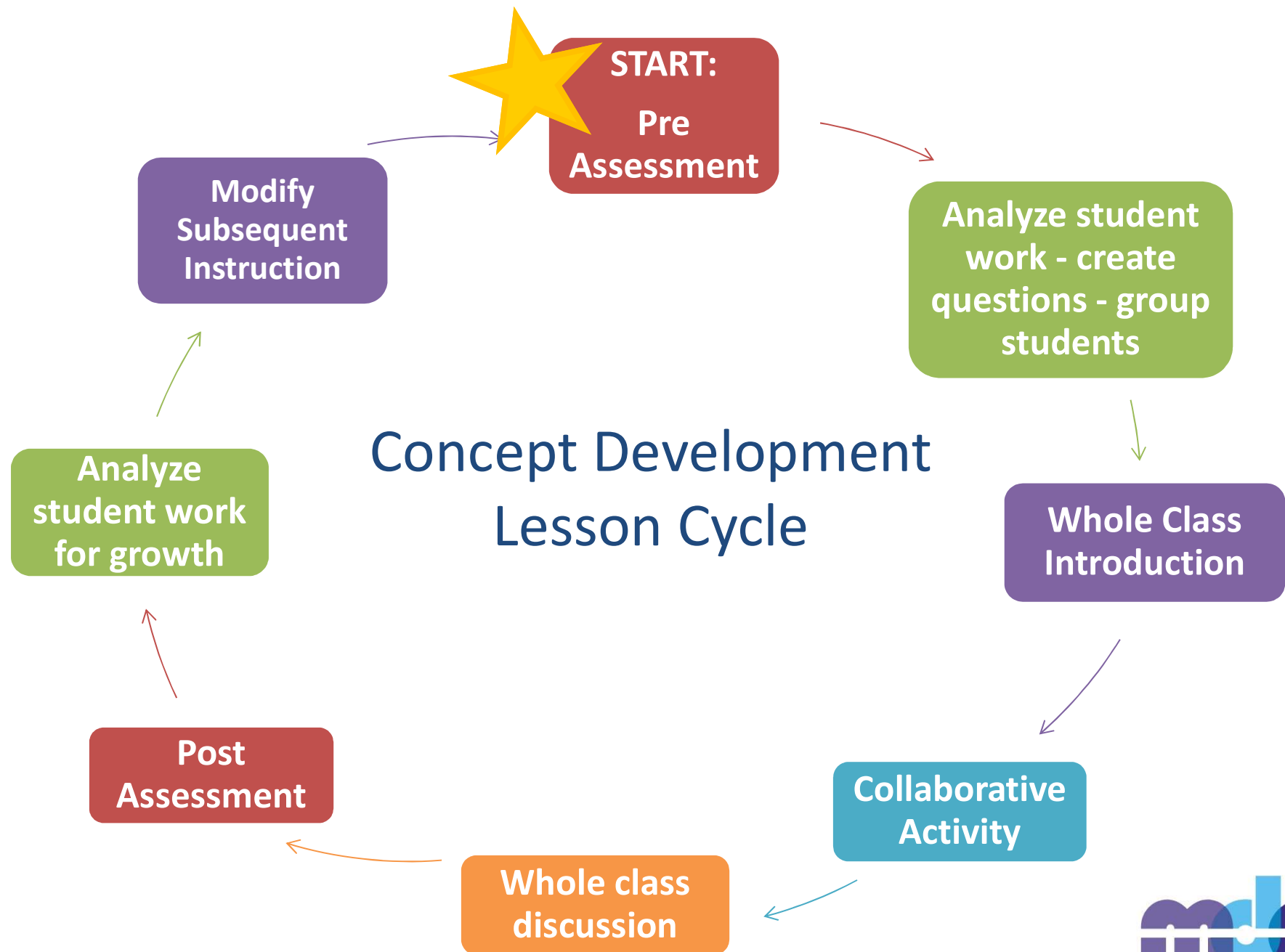
4 x 7 = 28

Area Model	Equal Groups
Repeated Addition	Word Problem

7 x 8 = 56

Area Model	Equal Groups
Repeated Addition	Word Problem

9



Concept Development Lesson Cycle

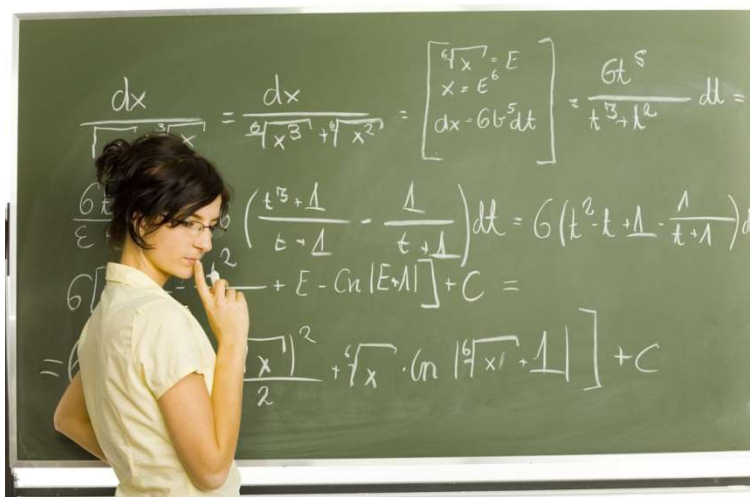
Whole Class Discussion

- Have a couple groups explain how they matched the cards and filled in the blank table from the card sort activity.
- Which cards were the easiest to match? Why?
- Which cards were difficult to match? Why?
- What strategies did you use?

Change in Instruction Based on Evidence

- Modify subsequent instruction
- Continue with remaining 1/3 of unit

“The test is too late...I need to know what they don't know now.”



Let's Talk Problem Solving



Stuck on an Escalator...Look Familiar?



What does problem solving look like in your classroom ?

&

How do you envision it looking?



Additional Thoughts:

- How often does problem solving occur?
- Is it embedded or stand alone after a unit?
- How does your vision differ from your current practices?

**Problem solving means engaging
in a task for which the solution
method is not known in
advance.**



**It involves a situation
in which a person
wants something and
does not know
immediately what to
do to get it.**



Problem Solving Lessons

- Heterogeneously group students to create one solution. (2-3 students)
 - Take note of different approaches to the problem
 - Encourage dialog between partners
 - Combine strategies- create a poster
 - Support problems solving



Benefits of Problem Solving Lessons

- Students are **sharing ideas**, communicating/explaining methods
- Exposed to **multiple approaches**
- Exposed to unique, **non-routine** problems
- Required to **analyze** other students' work
- Required to **diagnose others' errors** and misconceptions
- Required to **make decisions** about best method

What do students say?



MDC Lessons and Professional Development Resources

Go to: map.mathshell.org

The screenshot shows the homepage of the Mathematics Assessment Project Classroom Challenges website. The header includes the title "Mathematics Assessment Project CLASSROOM CHALLENGES" and "Formative Assessment Lessons (beta) for Grade 6". A navigation bar contains links: Home, MAP Overview, Lessons, Tasks, Tests, Professional Development, TRU Math Suite, Standards, Instructions, and Log In. Below the navigation bar, there is a search bar with "Formative Assessment Lessons (beta)" selected, "Grade 6" chosen, and a "Find" button. The main content area is titled "Designing: Candy Cartons" and includes a link to "Read more about the purpose of the MAP Classroom Challenges...". It lists mathematical goals, an introduction to the activity, and materials required. A sidebar on the left shows a list of lessons under "Grade 6" and "Problem Solving", including "Designing: Candy Cartons", "Optimizing: Security Cameras", "Sharing Costs: Travelling to School", "Solving Real-life Problems: Selling Soup", and "Modeling: Car Skid Marks".

Mathematics Assessment Project
CLASSROOM CHALLENGES
Formative Assessment Lessons (beta) for Grade 6

Home MAP Overview Lessons Tasks Tests Professional Development TRU Math Suite Standards Instructions Log In

Formative Assessment Lessons (beta) Grade 6 Find: Go

Designing: Candy Cartons
Read more about the purpose of the MAP Classroom Challenges...

Mathematical goals
This lesson unit is intended to help you assess how well students are able to:

- Select appropriate mathematical methods to use for an unstructured problem.
- Interpret a problem situation, identifying constraints and variables, and specify assumptions.
- Work with 2- and 3-dimensional shapes to solve a problem involving capacity and surface area.
- Communicate their reasoning clearly.

Introduction
This activity will take two lessons. The lessons are structured in the following way:

- Before the first lesson, students tackle the problem individually. You review their work and write questions to help students improve their solutions.
- At the beginning of the first lesson, students respond to your questions. They are then grouped into pairs and work collaboratively to produce better solutions to the same task, and use their designs to make two cartons.
- To launch the second lesson there is a whole-class discussion. Then in small groups students evaluate and comment on sample solutions, followed by a whole-class discussion about the work. Finally, students review and evaluate their work on the problem.

Materials required

Grade 6
Problem Solving

- ▶ Designing: Candy Cartons
- ▶ Optimizing: Security Cameras
- ▶ Sharing Costs: Travelling to School
- ▶ Solving Real-life Problems: Selling Soup
- ▶ Modeling: Car Skid Marks

Concept Development

Explore → Lessons,
Tasks, Professional
Development

Join SAS Community PA Mathematics Design Collaborative

- See “PDE SAS - PA Mathematics Design Collaborative Community” direction sheet.
- [Link](#) to PDE SAS
 - Follow directions on sheet to take through website.

Additional FALs/Resources

Keylearning.wikispaces.com

- MDC – Math Design Collaborative

Thank you for your
attendance, attention and
participation.

